

Date Sensitive Computing Problems

Dangers and Opportunities

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Executive Summary

The year 2000 bug will cause numerous failures in computer systems and computer controlled equipment around the world. These failures will damage society's infrastructure, alter its business environment, and cause many cultural changes. The resulting upheavals will present many dangers to society, but will also provide opportunities for those who are prepared to exploit them. Preparation will require more than just remediating existing equipment flaws. It will require reexamining the basic functions of society's organizations to insure effective operation in the post 2000 world. Fortunately, the United States is technologically, socially, economically, and politically the best prepared nation for the coming crisis. If America continues preparing for the crisis, much of the inevitable damage it will suffer can be quickly repaired. America and its citizens will be in an excellent position to take advantage of the opportunities available in the 21st century.

The New Future

The Y2k Bug

At the dawn of the year 2000 (y2k), a computer glitch (the y2k bug) will cause widespread failure of information technology systems and computer controlled equipment.¹ The number of failures can be reduced by remediating systems beforehand, but some failures are inevitable due to the limited time and resources. While the exact nature of these failures may not be known, their effects will be immense; they will be felt in every part of the world and at every level of society.

The present thinking on y2k generally assumes that some disruptions will be caused by the y2k crisis, but that we will eventually recover from them. We will not. Our society will not recover from the y2k crisis because it will be fundamentally changed by it. Our ability to produce goods and services will eventually return to pre-y2k levels, but we will not be socially or culturally the same. The post-y2k world will no more resemble the present than did the post-World War II world resembled the pre-World War II one.

Dangers and Opportunities

The changes caused by the y2k crisis will pose numerous dangers to our society, but will also generate opportunities for those prepared to exploit them. Businesses will have the opportunity to take customers from less prepared rivals and enter newly developing markets for alternative technologies. Charities and civic organizations will have the opportunity to recruit members and improve their standing in the community. Nations will have opportunities to negotiate favorable treaties and extend their sphere of influence. In order for our society to take advantage of the opportunities presented by the y2k crisis, we must work to minimize the number of y2k system failures and prepare ourselves to adapt quickly to the changes that will occur.

¹ For more information, see the NCRI publication "The Y2k Technology Crisis."

Likely Global Changes

It is impossible to predict exactly what changes the y2k crisis will cause, but a number of general trends can be projected. Every nation's infrastructure will be damaged; including telecommunications, transportation, power generation, even weather prediction capabilities. Supply and demand changes will radically alter businesses, leading to the implementation of alternate technologies. The shock of y2k failures will affect basic culture and social stability. Finally, the decrease in disposable income will reduce consumption of luxuries, both in products and in social choices.

Loss of Infrastructure

Potentially, the most damaging loss is the failure of the communication infrastructure. Communication is essential; without it, economic activities cannot be coordinated and it will become impossible to adapt to unexpected changes. The y2k crisis will decrease our ability to communicate not only by damaging equipment, but also by reducing our shared assumptions. During the y2k crisis, not even the most basic services can be taken for granted. This will require the exchange of substantially more information to coordinate the simplest operations. The combined effect of reduced communication bandwidth and increased need for information exchange when coordinating activities will impair management of complex operations at a distance. Many organizations will adapt by decentralizing and increasing the responsibility given to field personnel.

The second most important component of a society's infrastructure is the transportation network. Fuel must be transported to power plants and gas stations. Replacement components must be transported to damaged facilities. Raw materials must be transported to manufacturing sites and finished products to their end users. Reduction in the ability to transport personnel will further decrease an organization's ability to manage projects at a distance. Many businesses will abandon their just-in-time inventory systems as coordination of numerous small deliveries becomes more difficult and expensive. Increased transportation costs may also affect the geographical distribution of manufacturing sites, shifting production either closer to the end user or to suppliers in an attempt to minimize shipping expenses.

Other segments of infrastructure will suffer losses and decreased capacity as a result of the y2k crisis. Electric generation capacity will be reduced. Water treatment plants may fail. Weather prediction will be hindered. It is even possible that garbage collection and police protection may cease to be reliable. The overall effect of these failures will be to increase the amount of effort that must be expended simply to meet the basic needs for survival. An even greater concern is the fact that if too many of these systems fail, the very fabric of society may be threatened.

New Business Environment

The y2k crisis will affect all aspects of the business environment. The availability of supplies, including capital and labor, will be generally reduced. The demand for products will shift away from luxuries, and toward necessities and capital equipment to replace y2k related losses. As previously stated, the increase in communication and shipping costs will force changes in management style and organizational structure. All these factors will combine to promote the implementation of technically developed, but previously uneconomical alternative technologies.

The availability of nearly every item needed by business will be decreased, resulting in a corresponding price increase. From electricity to wheat, from steel to copier toner, everything will be in short supply. The supplies that will be hardest hit will be imports and items requiring highly computerized production methods. Imports will be reduced by both the increased cost of transportation and the possibility of societal breakdown in the country of origin. Items requiring complex production methods will suffer shortages when the computerized control systems fail, possibly causing damage to mechanical systems in the process. The general downturn in the economy will decrease the availability of capital, raising interest rates. The failure of businesses will raise unemployment and lower labor costs in some areas. In other sectors of the economy, high demand for workers to fix y2k problems may increase the cost of labor, especially skilled labor. Businesses will pass these higher supply and operation costs on to their customers; or they may fail if they cannot. The increased cost of all these items will encourage entrepreneurs to find substitutes for scarce materials, capital, and labor.

In addition to changing supplies, the y2k crisis will drastically alter demand for products and services. The general demand for exports will suffer drastic reductions for the same reason that imports will be curtailed. Equipment to replace items lost to the y2k bug will be in high demand, as will the skilled labor necessary to conduct the repairs. Demand for capital will also be increased by the need to finance the purchase of replacement equipment or the need to invest in alternative technologies. The general economic downturn and low consumer confidence will reduce consumption of luxury items. The same low consumer confidence will fuel an increase in the demand of 'survival' items and basic necessities as people stockpile for an uncertain future. These shifts in demand will force many businesses to either adapt or close. Whole industries may cease to exist when their products are not wanted, or their customers are unable to afford them.

There exist an almost infinite number of solutions to each technological problem. The selection of which path technology takes is driven by economic, cultural, and political factors. Some new technologies remain undeveloped simply because the high cost of tooling up to use them cannot be justified while the old technology continues to work adequately. The y2k crisis will change all of these conditions. The y2k crisis will damage a great deal of existing capital equipment. When businesses are faced with making large expenditures to restore this equipment to operation, they may instead choose to invest in different technology that is better suited for the post-y2k economic and social conditions. Even companies that elect to continue using traditional technology may upgrade old equipment to state-of-the-art during the y2k repair work. The overall effect could be an increase in the technical sophistication of businesses that survive the y2k crisis, with an eventual corresponding increase in productivity.

Cultural Changes

The y2k crisis will affect cultures around the world. Reduced effectiveness of police and military forces will cause less fear of authority. Groups discontent with society may become outright rebellious if economic or social conditions become harder as a result of the y2k crisis. People may blame current authority figures for failing to stop the y2k bug. Fear of the future will change people's personal habits, and could motivate radical political shifts.

Many effects of the y2k bug will reduce the ability of governments and societies to

enforce their laws and policies. The same shortages that harm businesses will also affect government agencies. Failure of computer systems and databases will handicap police forces in industrial nations who have come to rely on them for dispatching, identification checks, and other useful functions. Failure of alarm systems, or power blackouts, may leave homes, businesses, and government installations vulnerable to break-ins. Domestic political concerns combined with supply and equipment problems may prevent nations from deploying their military forces. All of these factors will reduce people's fear of authority. The domestic results of this will be an increase in crimes of opportunity and anti-social behavior by malcontents. The international result will be an increased violation of enforced treaties and policies. Historic cultural conflicts may be reignited in developing regions, if the aggressive parties no longer fear intervention by the y2k preoccupied industrial world.

Every society has its discontents. Some nations deal with these groups with the threat of force; others placate them with economic or social concessions. The y2k crisis will temporarily make life more difficult for most people. Simultaneously, the ability of societies to afford these tributes will be hindered. The previously mentioned dissatisfaction with authority figures and reduced police effectiveness will also increase the likelihood of rebellious behavior. Governments may respond by increasing the penalties against civil disturbances or by making political concessions. On the other hand, the humanitarian spirit and survival bonding that often surface during crises may outweigh any anti-social influences.

People will want to place blame for the y2k crisis. Some will blame prominent leaders in the computer industry or in government. Others will place the blame on society or the way society manages technology. As a result, there will emerge new political groups that seek to change the way society develops and exploits technology. There will also emerge new cults and closed communities that shun technology or seek to integrate it into their lives in a different fashion. Even general culture will see a shift in how technology is perceived, with a bias against brittle, highly interconnected systems.

After such a long time of relative peace and prosperous growth, many people will be psychologically unprepared for the temporary hardships that will be caused by the y2k crisis. Some people will become pessimistic, or even outright fearful of an uncertain future. Survivalism and personal preparedness will become more popular. Some degree of this cautiousness will become ingrained in the general culture, and persist long after the y2k crisis ends. Nations which do not have a well developed culture of democracy and which suffer from the aforementioned disenchantment with present authority, reduced fear of authority, and cessation of tribute to discontented groups, will prove to be fertile breeding ground for oppressive regimes. Even strongly democratic nations will have to be on guard against the temptation of demagoguery and unfounded backlashes against existing authority.

As stated previously, the decrease in the disposable income of society will necessitate a reduction in the consumption of luxuries. Not all luxuries are the product of business, however. Some take the form of societal choices and pursuits. These luxuries are the products of governments, charities, institutions, and other non-profit and civic groups. They are the noble pursuits of humanity, from artistic endeavors to environmental conservation, from archeological digs to space exploration. They are worthy goals, but

are not necessary for the short term survival of society. People of all societies are curious, artistic, and prefer clean air. These societal luxuries, however, exist primarily in modern industrial nations whose great wealth can support expensive non-essential projects and whose relatively rich citizens are willing to increase their cost of living through regulations in exchange for safer, more pleasant surroundings.

In countries with a free market economy, many of the reductions in social luxuries will be automatic. Non profit groups that society considers unessential will experience a decrease in donations. With less financial resources, these organizations will curtail their activities. Social luxuries that are pursued through government will not automatically adjust to the appropriate level for the current social and economic situation. They must be adjusted through deliberate efforts by politicians and bureaucrats. Because governments operate through the rule of law, they have the option of continuing to pursue these social luxuries in the face of public opinion and the free market. Continuing these luxuries, however, would come at the cost of public support. Leaders or agencies that continued to fund programs or maintain regulations which are inappropriate for the social situation could suffer a political backlash that would place at risk not only the programs in place at the time, but may prevent the reestablishment of those programs after the y2k crisis is over. Some governments may be tempted to leave inappropriate regulations in place, and merely not enforce them during the y2k crisis. Unless this policy is officially announced with specifics, it could undermine the governments involved by creating legal and cultural precedence against the regulations and, by extension, weaken the foundation of all laws.

Y2k Preparation

Current Shortcomings

There already exist a plethora of literature describing procedures for preparing organizations for the y2k crisis.² Unfortunately, these methods do not take the larger societal changes into consideration. The prevailing wisdom instructs organizations to determine ways to continue conducting their operations through the y2k crisis, without first determining if those operations will even be compatible with the needs of a post-y2k society. Y2k experts use terms such as 'remediation,' and 'recovery,' as if our efforts to repair the y2k disruptions will allow the world to return to normal. The problem with such thinking is that 'normal' will have changed. Organizations that continue to operate with outdated ideas and assumptions will fail regardless of how successful the technical aspects of their y2k repair work may have been. For organizations to be properly prepared for all the challenges that the y2k crisis will bring, we recommend that the considerations outlined in this section be added to current remediation procedures.³

² For example, GAO/AIMD-10.1.14, "Year 2000 Computing Crisis" and GAO/AIMD-10.1.19, "Year 2000 Business Continuity and Contingency Planning."

³ For more information, see the NCRI publication "Preparing Your Organization for the Y2k Crisis," to be released in Oct., 1998.

Recommended Changes

Mission Definition

In order to know how to prepare for the y2k crisis, an organization must first understand what it wants to achieve. A clear, but not overly specific, mission statement should be formulated. Many organizations already have mission statements; some of these mission statements do not accurately reflect the real goals of the organization and are used more for propaganda than direction. Selection of an appropriate mission statement is important for making any kind of future plans and preventing an organization from focusing its efforts on the wrong goals. For example, a business whose mission statement is "manufacture the best buggy whips in the world," will not respond to change as well as one whose mission statement is "profitably mass produce consumer leather products," or perhaps simply "make as much net profit as we legally can, by employing and directing workers to produce valuable goods or services." In the post-y2k world, where changes will be large and rapid, organizations must have a clear goal to guide their efforts, but not one so specific that it restricts their vision.

Flexibility

Current y2k preparation methods tend to focus on how an organization can ensure that its present operations continue after y2k. Because of the large societal changes the y2k crisis will cause, however, the best way to achieve the organization's mission may not be through continuing its present operations. Organizations should examine likely y2k scenarios and determine the best way to achieve their mission under those conditions. Current operations should be remediated only if they will be appropriate for the post-y2k fulfillment of the organization's mission. Flexibility and creative problem solving will be important traits for dealing with the y2k crisis.

Suppliers

Current y2k preparation methods recommend ensuring that all critical suppliers are also prepared for the y2k technological crisis. The definition of suppliers must be broadened to include not only suppliers of physical items, but suppliers of capital, labor, and anything else the organization uses. Making sure suppliers are prepared, therefore, means making sure that every employee is personally prepared for the y2k crisis. A person who is preoccupied with the safety of his family will not be a very effective worker. Organizations must educate all personnel on steps they should be taking to prepare themselves and their families for y2k or risk losing their labor force.

Training

Because all systems cannot be made ready for y2k, and because the exact nature of the y2k crisis cannot be predicted in advance, the ability to react quickly to y2k failures, and repair or bypass affected systems will be essential. Training for y2k failures in advance can greatly increase an organization's ability to manage the y2k crisis.⁴ Organizations should identify critical failures from likely y2k scenarios, develop contingency plans for those failures, and train personnel on the execution of those contingency plans.

⁴ More information on y2k training, as it applies to the electric power industry can be found in "Training to Avoid Y2k Power Problems," by Dick Mills available at www.y2ktimebomb.com/PP/RC/rc9826.htm.

The Y2k Organization

This section lists the characteristics that an ideal organization would possess for success during the y2k crisis.

1.0 Well defined mission

The organization must have a realistic mission statement that is sufficiently flexible to allow adaptation to new and changing circumstances.

2.0 Organization wide acceptance of mission

Every member of the organization should understand and accept the mission statement, and their role in it. If communication within the organization is hindered, each section of the organization should continue to support the mission as much as possible.

3.0 Sufficient capital resources

Almost every organization will require some equipment. Appropriate equipment should be available to support the mission.

4.0 Adequate supplies

Almost every organization continuously consumes supplies (money and labor at a minimum). Appropriate supplies should be available when needed to support the mission.

4.1 Approved suppliers

The first step in assuring adequate supplies is usually to require current suppliers meet some standard of preparedness and reliability.

4.2 Alternate suppliers

Even if all suppliers are approved, alternative scenarios should be considered as a concession to Murphy's Law.

4.2.1 Ability to produce or procure unavailable supplies internally

4.2.2 Ability to modify procedures to use alternate (or no) supplies

4.2.3 Stockpiles of supplies to permit continuous operation

5.0 Ability to adapt to a changing environment

The organization should be able to modify its procedures, assets, and structure as dictated by changes in its environment to allow it to continue fulfilling its mission.

5.1 Small Boyd Cycle⁵

5.2 Good intelligence

In order to adapt to a changing environment, the organization must first be able to quickly and accurately identify the important environmental factors that need reacting to. The ability to predict likely changes in advance gives an even greater edge.

5.3 Generalized contingency plans

The organization should have pre-written contingency plans to deal with the changes predicted by the good intelligence the organization has. To be useful, the plans must be accessible to the people who need them. Ideally they should

⁵ The Boyd Cycle or OODA Loop is the repetitive cycle of observation, orientation, decision, and action that an organization goes through to react to change. The OODA Loop was conceptualized by Col John Boyd (USAF Ret) from his study of military encounters.

be practiced in advance to ensure smooth implementation.

6.0 Structure that supports operation in a y2k crisis environment

There are two structures likely to function well in the sort of environment which will probably occur during the y2k crisis, small and homogenous structures, or large, diverse, and decentralized ones. Small and homogenous organizations will be able to adapt quickly and will be less impacted by communication and transportation failures; they are, however, more likely to be destroyed entirely by y2k related failures. Large, diverse, and decentralized organizations will probably lose some of their structure during y2k; but their robust nature makes it likely that some portions will survive no matter what the conditions. A well defined and accepted mission will allow the remaining structure to rebuild damaged segments. Ideally the large, diverse, and decentralized group would be composed of small and homogenous components at its elemental level.

7.0 Adaptable personnel

Ultimately, the success of an organization depends on its people to make decisions and take actions. Even though the organization's contingency plans are based on good intelligence, they will not be perfect; in these cases personnel should be able to operate without pre-written procedures. The members of the organization will have to be able to function under pressure and have the authority to take action, in order to avoid unforeseen dangers and take advantage of unexpected opportunities. These traits and responsibilities should extend to the lower levels of its structure, to prevent decapitation during communication losses.

America, The Ultimate y2k Organization?

Readiness

Even though the United States of America will not be perfectly prepared for the y2k crisis, it will almost certainly be the nation most fit to succeed in the post-y2k world. America already meets most of the criteria of an ideal y2k organization; and its shortcomings can be largely remedied before the y2k crisis hits. This section makes a point by point comparison of the 'ideal y2k organization' with the United States of America and offers suggestions for further preparation.

1.0 Well defined mission

From the days of the American Revolution, through the years of Manifest Destiny, to the present time of the Global Policeman, Americans have always had a clear vision of their place in the world. We see our nation as the protector and promoter of constitutional democracy and human rights. Our government, in the Declaration of Independence, the Constitution, and the Federalist Papers, has an almost perfect example of a well defined mission statement and supporting documentation. Most of our large societal organizations follow this lead with mission statements of their own. Modern quality control trends continue to promote this practice.

2.0 Organization wide acceptance of mission

Even though America is in some ways the most culturally diverse nation in the world, it also has a great deal of shared culture. Children from all regions of the country and all ethnic groups grow up watching the same television programs, eating the same fast

food, and playing the same sports. The result of this common culture is a widespread acceptance of the assumptions upon which our society is based. Because of the nature of mass communication and mass production, Americans have a great deal of shared culture and a very widespread acceptance of our mission statement.

3.0 Sufficient capital resources

Even though there is a great deal of concern about whether or not enough of America's equipment will be y2k compliant, there is no doubt that the United States is leading the world in preparation for y2k. America will suffer the loss of some percentage of its equipment to the y2k crisis, but other countries will lose far more.

4.0 Adequate supplies

4.1 Approved suppliers

Unfortunately, it is impossible to assure that all the supplies used by any nation will be coming from approved suppliers. It is important, therefore, to be sure that the United States will be able to find alternatives should present suppliers no longer be reliable after y2k.

4.2 Alternative suppliers

4.2.1 Ability to produce or procure unavailable supplies internally

Because of its large size and geographic diversity, America has an abundance of natural resources. We can be self sufficient in the production of food, energy, and most all strategic materials. We also have vast reserves of capital, labor, and technical knowledge.

4.2.2 Ability to modify procedures to use alternate (or no) supplies.

America conducts business with practically every region on the globe, so imports lost because of foreign chaos may be available from other trading partners. Even in cases where alternative sources of needed supplies are unavailable, application of capital and technical knowledge may allow the development of substitutes or modification of processes to eliminate the need for those resources.

4.2.3 Stockpiles of supplies to permit continuous operation

It is important that our nation increase its stockpiles of strategic materials to allow us to continue operations while alternatives are implemented, if shortages occur.

5.0 Ability to adapt to a changing environment

America's competitive nature has forced most of our nation's organizations to become very responsive to changes in their environment. Even if no business changes its operation to better fit the post y2k environment, our free-market economy as a whole will still adapt. Businesses that are not well suited to the post y2k environment will fail; their supplies, capital, and labor will then be available for use by businesses that happen to be adapted to their present environment. The constant pressure to find an advantage over competing businesses will cause even more rapid and complete adaption. A similar effect will cause adaptation of non-profit organizations as they compete for donations. Our democratic political system will cause governmental organizations to be reformed by political leaders competing to win the approval of voters. Our democratic government and capitalist economy have made us the most competitive nation on Earth. As a result, we will be the quickest to adapt to the post-y2k world and the first to exploit its opportunities.

5.1 Small Boyd Cycle

In order to maintain our small Boyd Cycle, it is essential that we maintain the ability to communicate thoughts and transport items quickly in the post-y2k world. These systems are so essential that an effort to develop emergency alternatives should be conducted concurrently with the preparation of existing communication and transportation equipment.

5.2 Good Intelligence

The United States government should invest heavily in its intelligence organizations. Analysis should be conducted and projections made for the effects of likely y2k events on this and other countries. Private sector organizations must share information on y2k preparedness so that likely failures can be anticipated and opportunities prepared for.

5.3 Generalized contingency plans

America's private and public organizations should use the intelligence they will gather to develop better contingency plans. The American people should be informed of their role in these plans, and how they should prepare for and behave during the y2k crisis.

6.0 Structure that supports operations in a y2k crisis environment

Because of America's large size and diverse nature, it is likely that some portions of the country will be able to survive even the worst y2k scenario relatively intact. These areas can then serve as staging grounds for efforts to rebuild the more damaged segments of the country. The diverse nature of our culture makes it unlikely that groupthink will prevent solutions to y2k problems from being found. The competitive nature of America's businesses and the redundancy in its many levels of government mean that there are numerous organizations capable of fulfilling the various basic needs of society. America's economic and political diversity mean that even if individual businesses, agencies, charities, and churches fail, the basic societal functions they serve will still be met by new or remaining organizations.

7.0 Adaptable personnel

Americans are traditionally very independent and enterprising. These qualities will make Americans well prepared to deal with the changes brought about by the y2k crisis. Most of our larger national rivals have societies that encourage conformity to the ideas espoused by a centralized leadership. These nations will not function well when the y2k crisis forces them to innovate and take action before consensus is reached. America, which already encourages individualism, initiative, and adaptability, will not be as destabilized by the y2k crisis and will be more inclined to take advantage of the opportunities presented.

Hope for the New Future

At first glance, the y2k crisis seems to present only dangers by destabilizing our existing world structure, but it also offers opportunities. The y2k crisis will favor societies that are adaptable and have prepared for the likely changes it will cause. America is already highly adaptable; we must continue working to ensure that we are the best prepared nation for y2k. By being the least destabilized and the quickest reacting nation, America will have many unique opportunities. Internationally, we can use our early recovery to negotiate favorable treaties and win allies with offers of assistance. Our economy will become less dependent on imports, and our businesses will have numerous opportunities to enter new industries and win new customers. Domestically, organizations will be

forced to reexamine their basic mission, invest in new technology, manage themselves more efficiently, and eliminate unnecessary components. Once the y2k crisis has passed, these improvements in efficiency and elimination of organizational deadwood will lead to increased productivity and less waste. Even though the y2k crisis will present our society with numerous dangers, it will also give us the kind of opportunities for societal renewal and expansion that come along only once in a thousand years